

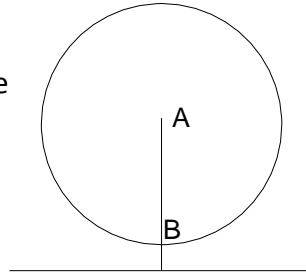
ACHIEVED questions – equation given

28. The height of sea water about the mean sea level due to tides is given by $h = A \cos\left(\frac{\pi}{4}t\right)$, where $t =$ time in hours after high tide and A is the height of high tide in metres.
High tide of 2.5m occurs at 2pm.

- Sketch the graph of $h = A \cos\left(\frac{\pi}{4}t\right)$
- Find out the time when the first low tide occurs after 2pm.
- Calculate when the height of the tide is first at 1m. Give your answer to the nearest minute.

29. A ferris wheel at a showground rotates clockwise about its centre A . Passengers get on at point B . A seat starts at point B and t seconds later it is h metres above ground level.

$$h = -8 \cos\left(\frac{\pi}{20}t\right) + 9$$



- How long does one complete rotation take?
 - What is the length of the radius of the wheel?
 - How high is B above the ground?
 - How high above ground level does the seat rise?
 - What is the height of the chair after 30 seconds?
30. A spring oscillates about a mid position. The length of the spring in mm after t seconds is given by -
 $l = 128 + 24 \sin 4t$
- How long is the spring when it is stationary?
 - What is the maximum length of the spring?
 - What is the length of the spring after $\frac{3}{4}$ of a full cycle?
 - What is the period of the motion?
 - What is the frequency of the motion?

MERIT questions – equation to be worked out

56. A concrete boat ramp is at 30° to the horizontal. Jules marks the concrete at the highest point the water reaches and his friend Verne marks the lowest level reached by the water. The distance between the two marks is 3.2 metres.
The two budding scientists then marked the halfway point between the high and low tide marks. They discovered that the movement of the tides was uniformly cyclic and occurred at 12 hour intervals.
- Assuming we start our clock when the water is at its lowest level, write a trig equation that will model the **vertical** movement of the tides.
 - For what fraction of the cycle time will the water be above a mark on the concrete exactly 1 metre below the high tide mark?
 - Where will the water level on the ramp be 10 hours after the start?

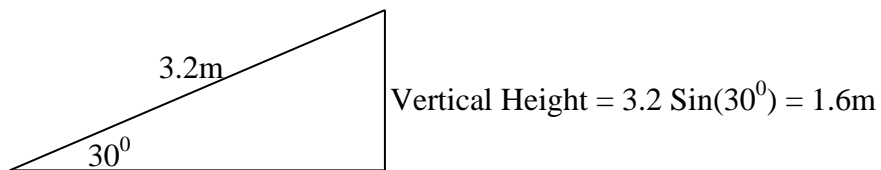
SOLUTIONS:

28. ii. $t = 4$ hours after 2pm, i.e. 6pm
iii. $t = 1.476$ hours = 1 hour 29 minutes after 2pm, i.e. 3:29pm

29. i. 40 seconds
ii. 8 metres
iii. 1 metre
iv. 17 metres
v. 9 metres

30. i. 128 mm
ii. 152 mm
iii. 104 mm
iv. $\pi/2$ seconds
v. frequency = $1/T = 1/(\pi/2) = 2/\pi$

56.



$Y_{\min} = 0$ metres, $Y_{\max} = 1.6$ metres (vertical height), $T = 12$ hours

$A = 0.8$, $B = 2\pi/12 = \pi/6$, $C = 0$, $D = 0.8$

- a) $Y = -0.8\cos(\pi t/6) + 0.8$
b) Water level is 1.1m(vertical height) at $t = 3.734$ hours and $t = 8.266$ hours, which is a period of 4.532 hours out of the full 12 hour cycle. $4.532/12 \approx 1/3$ of the full cycle.
c) At $t = 10$ hours, $Y = 0.4$ metres(vertical height above lowest level), which is 0.8 metres above the lowest level on the concrete ramp.